N92-14523

Biennial Research Summary

A. Title: **Rocket Temperature Soundings**

B. Investigators and Institutions:

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C. Abstract:

Provide rocket-borne measurements of temperature and wind. These data are used to obtain a better understanding of the processes that control the chemical and dynamical behavior of the stratospheric region, to monitor temperature trends and detect changes, to verify and monitor remote measurements (ground- and satellite-based), to provide direct wind measurements for verification of the balance wind derived from remote measurements, and to provide density measurements for large space vehicle operations.

D. Progress and Results Summary:

During the period October 1988 and June 1989, twenty-six measurements of temperature and wind were obtained using the Super Loki Datasonde rocket instrument. Eight system failures occurred between March and June, and eleven payloads were rejected for various reasons. The failures and the rejected systems impacted the continuity of the desired one per week launch schedule. Since July, there have been no launchings because of lack of rocketsonde systems. It was assumed that the total number of systems would be sufficient until newly procured flight hardware could be delivered during September. It is important that the inventory contain enough flight systems so that the one per week launch schedule can be maintained. So far, funds have been insufficient to meet this objective.

Some analysis of the existing rocketsonde data available from all the launch ranges has been used to study temperature trends. This required considerable review and quality control of the data files, and in some cases a complete re-evaluation of the data needed to be made. The temperature trend since 1969 has been downward, however, before an accurate value can be fixed we must consider the trends being displayed by other measurements systems such as satellite retrieved temperatures. This involves much more work, but we have TOVS data in hand and are beginning to examine how well the two methods (rocket and satellite) agree. We have also spent some effort in looking at the falling sphere technology. The sphere has been found to provide quite accurate temperature measurements between 85 km and the point of sphere collapse (near 35 km). The sphere uses the gas equation to determine temperature from density and pressure. Density is the basic parameter calculated by solving the equations of motion for the falling sphere; radar position data are used. For various reasons (i.e., wrong sphere weight is a major source of error) the density data may be in error up to 5-10 percent; this density value is used to calculate a pressure. Any error in density appears as a similar magnitude error in pressure so that solving the gas equation cancels the error leaving an accurate value of temperature. Consequently, given a linear error in density the temperatures retrieved will be quite accurate between 35-85 km. This has been demonstrated theoretically, with computer simulation, and with actual flight comparisons between spheres and Datasondes, and was presented in a paper given at the 9th ESA Symposium.

E. Publications:

Schmidlin, F. J., H. S. Lee, and W. Michel, 1989: Evidence for accurate temperatures from the inflatable falling sphere. Proceedings of 9th ESA Symposium on European Rocket and Balloon Programs.

Luebken, F., U. von Zahn, A. Manson, C. Meek, U. Hoppe, F. J. Schmidlin, et al, 1989: Mean state densities, temperatures, and winds during the MAC/SINE and MAC/EPSILON campaigns. J. Atmos. Terr. Phys.

Goldberg, R. A., D. Fritts, A. Chou, J. Barcas, and F. J. Schmidlin, 1988: Studies of high latitude mesospheric turbulence by radar and rocket - 1: Energy deposition and wave structure. J. Atmos. Terr. Phys.

Blood, S., J. Mitchell, C. Croskey, A. Raymund, E. Thrane, T. Blix, U. Hoppe, D. Fritts, and F. J. Schmidlin, 1988: Studies of high latitude mesospheric turbulence by radar and rocket - 2: Measurements of small scale turbulence. J. Atmos. Terr. Phys.